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ABSTRACT

This publication is designed as a model to assist elementary teachers in developing environmental education activities in all subject areas. Both public school and college educators developed this guide to help make children aware of the value of the environment and of the responsibility they have for conserving it. Discussions of the curriculum model for the guide and the program format and criteria are included for the teacher. The curriculum model demonstrates the interrelationships of personal concerns, environmental concerns, and educational process. A multidisciplinary approach is an important component in every suggested activity topic. Some of the areas covered are environmental ethics, types of pollution, population, urbanization, transportation, and energy. Each topic includes a short overview and a listing of generalizations and suggested pupil activities. The educational experiences and activities are designed to individualize student learning, emphasize community involvement, and encourage exploratory and investigative learning. A companion guide is also available for secondary grades. (Author/MA)

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Suggested Activities for Environmental Education in the Elementary Schools

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Suggested Activities for Environmental Education in the Elementary Schools

**Division of Curriculum Development
Texas Education Agency
201 East 11th Street
Austin, Texas 78701**

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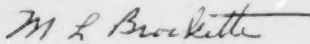
If there is a direct violation of the Court Order in Civil Action No. 5281 that cannot be cleared through negotiation, the sanctions required by the Court Order are applied.

FOREWORD

Environmental Education in the Elementary Schools: Suggested Activities is designed as a model to assist elementary teachers in developing environmental education activities in all subject areas.

This publication and a companion, *Environmental Education in the Secondary School: Suggested Activities*, publication number CU7 832 03, were developed by public school and college educators.

We hope this guide will help to make children aware of the value of the environment and of the responsibility they have for conserving it.



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to Initiate an Environmental Program*.



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INTRODUCTION



Within the past two generations, Texas' population has more than doubled and has dramatically changed from rural to urban. As a result of these changes, citizens have greatly altered their surroundings thus creating many environmental problems. Pollution of the environment, unplanned land development, and the struggle of plants and animals to survive are but some of the pressing problems humans have created.

Each citizen's attitude toward the management of the earth's resources will eventually determine the quality of life which can be expected. Direct experiences with a wide spectrum of resources will prepare individuals to cope with the problems of the environment. These experiences are absolutely essential to shaping constructive attitudes. One cannot really learn from books about conservation of resources. Positive attitudes toward the wise use of resources and the avoidance of excessive pollution will develop through direct involvement with management practices. Strategies must be developed to provide real experiences for pupils in their daily educational activities.

These environmental activities must be multidisciplinary and must be structured around real objects and events in the community which young people encounter in everyday living. Conservation can then become a part of life rather than merely a preparation for the "good life." Every facet of human concern must be a basis for designing educational experiences for pupils.

Teachers and administrators of Texas public schools have expressed the need for a resource guide to aid in the development of environmental education experiences throughout the curriculum, kindergarten through the twelfth grade. This guide for elementary administrators and teachers represents an effort to meet part of that expressed need. It provides for pupils in kindergarten through the sixth grade an array of direct involvement activities which are based upon human concerns ranging from personal and economic security to consumer behavior and career activities. Minimum emphasis is placed upon listening and maximum emphasis is placed upon action.

CURRICULUM MODEL FOR THIS GUIDE

The pupil activities and outcomes contained in this guide are based upon a three-dimensional model which emphasizes:

- (1) Personal concerns of people
- (2) Problems of environmental quality
- (3) Learning functions of students

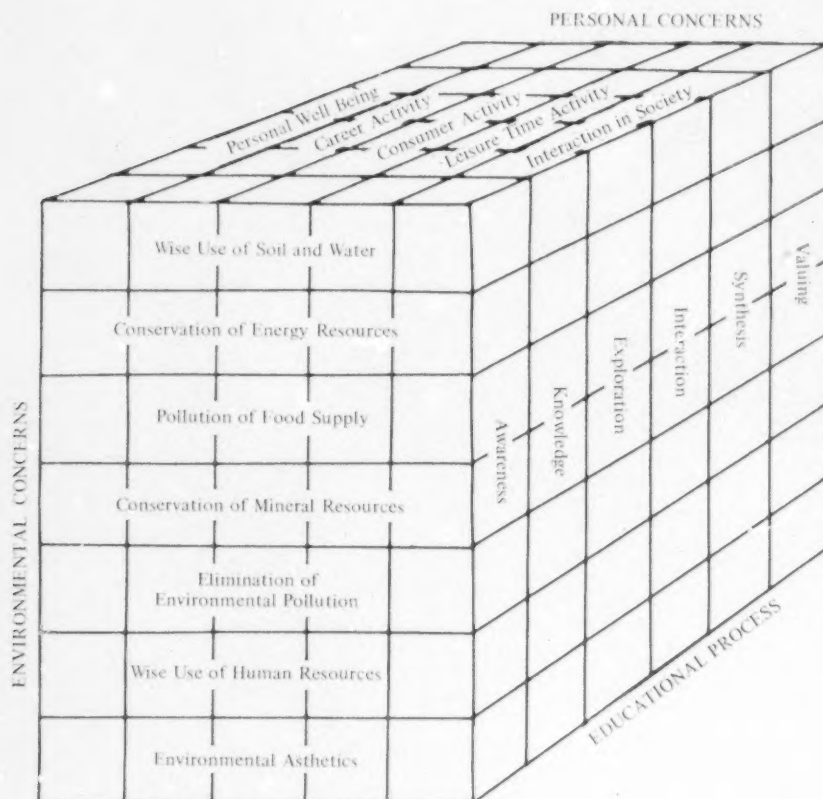
The model below demonstrates the interrelationship of these basic factors. For example, a learning activity can be constructed around the first cube in the model (upper left corner) which demonstrates the intersection of Personal Well-being, The Use of Soil and Water, and Awareness Level of Educational Process. The learning activity, therefore, would center on how an awareness of wise soil and water conservation practices can affect the personal well-being of each individual.

The following model illustrates the interaction of these three dimensions. The intersection of the three

dimensions of the cube model — environmental concerns, personal concerns, and educational processes — provides the 210 program cubes which serve as a base for curriculum building.

As illustrated in this model, all people, regardless of age, economic status, or field of work, have the same basic concerns. Each person is most directly concerned with personal health and well-being. To live the "good life," one must be free of chronic illness and have a healthy and positive self-image. By the same token, everyone should be interested in a productive and satisfying career. People who view their jobs as interesting, productive, and economically satisfying have a greater chance for personal happiness. In these days of rising prices and shortages, an increasing amount of attention is being focused upon consumer affairs. People are concerned with getting their money's worth and not being overcharged for goods and services.

Recent technological advances that provide



citizens with more leisure time have focused increased attention on the productive and satisfying use of leisure time. As the recreational industry grows, so does the need for wise utilization of resources for recreation in our state and nation. In addition to the personal concerns for well-being, career choice, consumer activities, and recreation, an increase in population has brought about the need for living in greater harmony with society. People-to-people problems have become more acute as evidenced by a rise in certain crime and by increased questioning of credibility of politicians and individual citizens.

The second dimension of environmental education is directly related to the immediate and long-range problems in the environment. The daily newspaper provides ample evidence that our nation must increasingly deal with environmental problems related to energy reserves, food supplies, and pollution. Basically, the environmental problems addressed in this guide relate to the following:

- The Wise Use of Soil and Water
- Conservation of Energy Resources
- Pollution of Food Supply
- Conservation of Mineral Resources
- Elimination of Environmental Pollution
- Wise Use of Human Resources
- Environmental Aesthetics

The three-dimensional model on page 2, illustrates how each of the areas of human concern can be related easily to the individual's use or abuse of the resources which this earth provides. For example, personal well-being is directly related to an adequate supply of wood and water and to the wise use of soil resources. Nu-

merous careers are based upon the conservation and proper utilization of soil and water. By the same token, there is a direct interaction between such personal concerns as career and leisure time activities and the problems which excessive environment pollution produces.

The third dimension of the curriculum model upon which this guide is based is that of individual learning processes. Each educational activity begins with a level of awareness. A successive series of steps, through knowledge and exploration, helps the pupils develop a value system. Valuing, of course, represents the highest level of educational processes. The educational functions which represent the third dimension of this model include the following:

- Awareness
- Knowledge
- Exploration
- Interaction
- Synthesis
- Valuing

An example of putting all three dimensions together would look like this: Awareness of the need for wise use of soil, water, plants; conservation of energy resources, food supply, mineral resources; and elimination of environmental pollution help to promote personal well-being.

It is suggested that the teacher refer to the three-dimensional curriculum model presented earlier and go through the mental process of interrelating any one or more of the concerns expressed within the three dimensions. This background activity is designed to provide direct, useful classroom learning experiences for children.

PROGRAM FORMAT

A resource guide, to be useful, must have a simple format along with explicit instructions for classroom utilization. In this guide, each program module is divided into three main sections:

1. An overview and discussion for the teacher, which provides background information and additional teaching resources
2. A statement of generalization to be developed including its relationship to the content area and its interrelatedness to environmental problems, personal concerns, and level of educational activities
3. Suggested student activities for use by individuals or small groups working on their own to investigate and assemble knowledge and ideas

This particular guide is designed for the elementary school level.

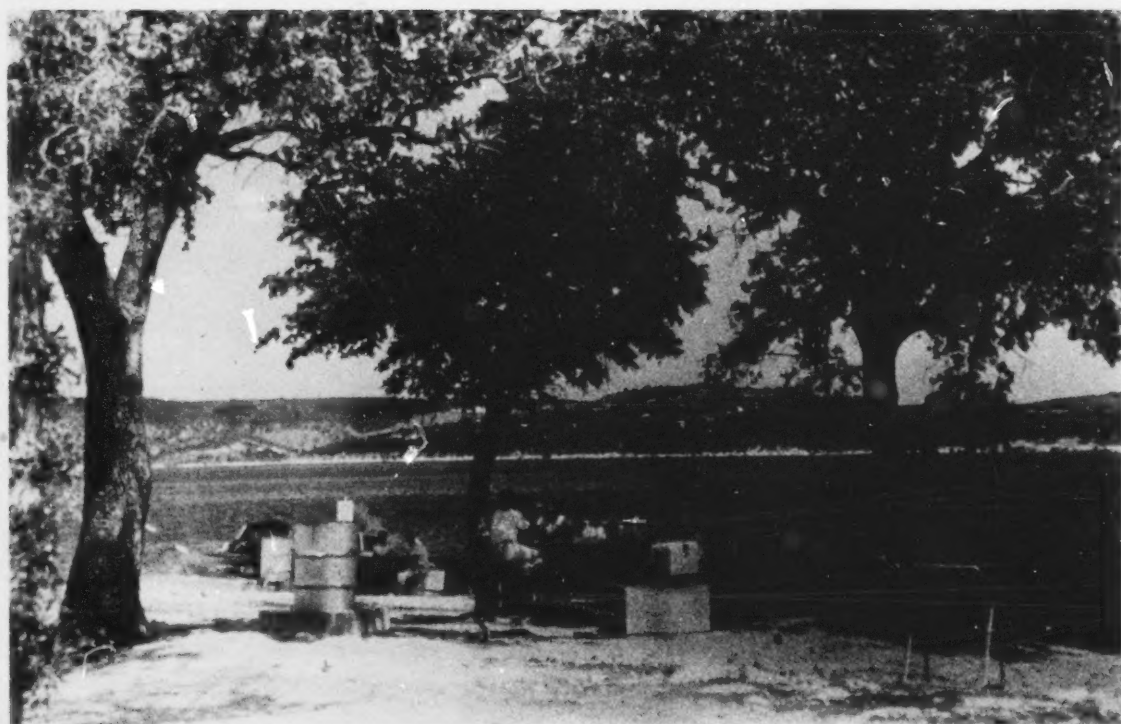
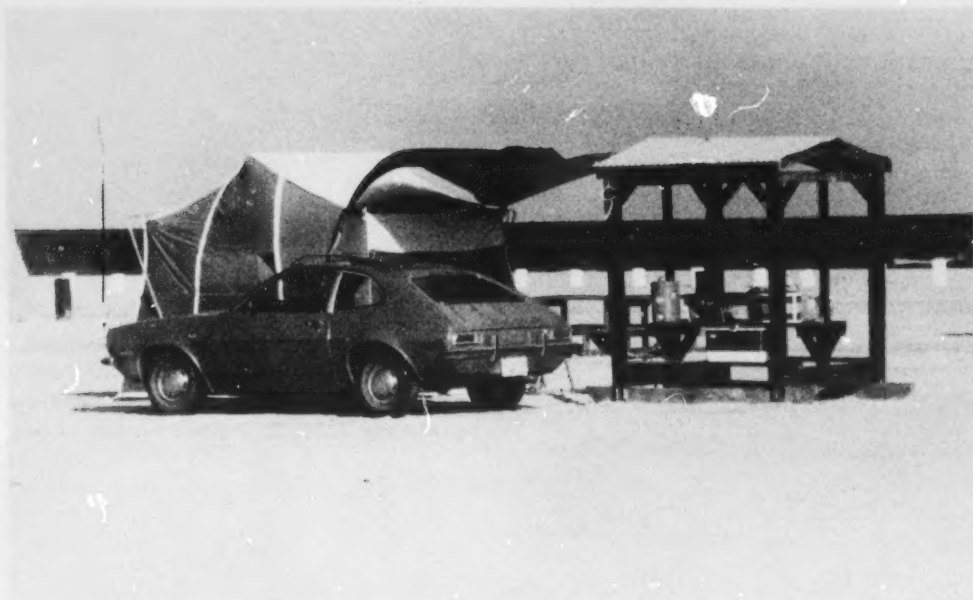


PROGRAM CRITERIA

All the educational experiences and activities contained in this guide have been designed with the following quality control criteria in mind:

- Each learner activity is derived from an interaction of personal concern about environmental problems with a learning process, such as observing, predicting, or analyzing.
- Each learner activity is individualized so that the learner assumes the primary role in investigating and finding answers.
- All learner activities are designed so that readily available resources can be used.
- Emphasis in each learner activity is placed upon community involvement and support.
- Learner activities are designed so that they will be not only informative but also exploratory and investigative.

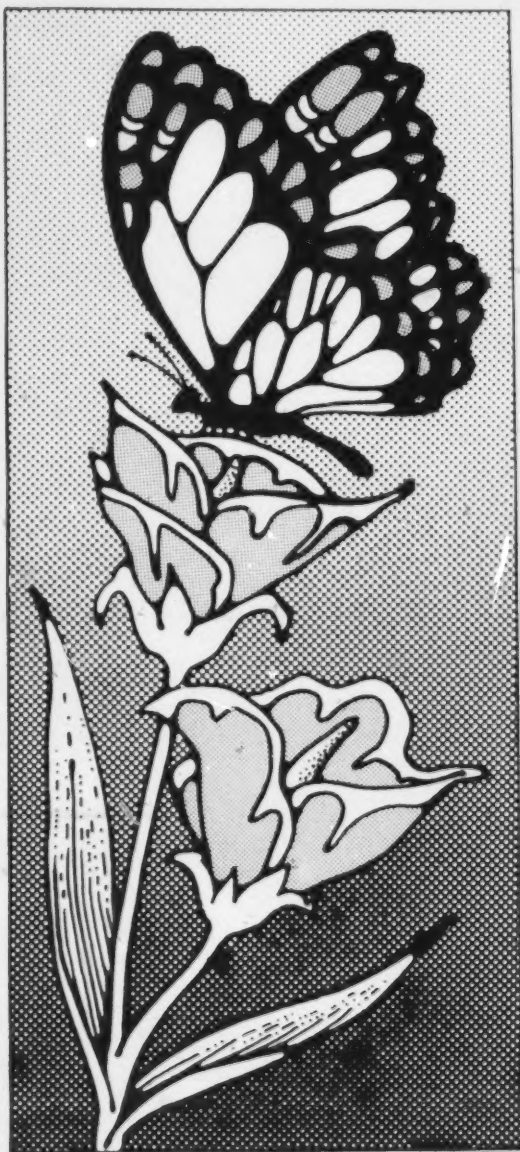




ENVIRONMENTAL ETHICS

OVERVIEW

All inhabitants must share the bounty—both living and nonliving—of the planet earth and preserve it for future generations. *Environmental ethics* is respect for the needs of all living things and a self-commitment to use all resources wisely.



GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. **Acquisition of environmental ethics is a continuous process of evaluation of all available information.**
 - 1.1 Discuss and list in a group on newsprint many ways people in your community are protecting natural resources and ways they are using them carelessly.
 - 1.2 Depict through art activities stories about some of the ways people have either improved or harmed the environment for living things or how the environment has changed because of human influence in the immediate area.
 - 1.3 Locate and visit an area in which natural resources have deteriorated. Take pictures of the area, label the pictures, and discuss in class how incidents could have been avoided.
 - 1.4 Survey existing problems in the school area: (a) drainage, (b) litter, (c) health hazards, (d) visual appearance. Form student committees for each problem and plan how improvements could be made.
 - 1.5 Invite a guest speaker to discuss values and ethics in relation to the environment. Follow up this discussion with a self-evaluation.
2. **Living things are interdependent upon one another and upon their environment.**
 - 2.1 Build a balanced aquarium or terrarium to learn how plants and animals depend on each other. During the project, which should last several days, different students may report orally to the class about changes taking place. Have students give their reasons for changes.
 - 2.2 Discuss the following: How does the environmental pattern affect the way people live? What are the major industries in the immediate area? How do these industries affect the water, air, land? On what resources do they depend? What natural resources are used for recreation? What is meant by "natural resources?" List resources in the local area on a map. Are they being wasted or protected? How are these local resources being wasted or protected? What can students do to help protect resources?
 - 2.3 Visit a museum or view a film about animals that are extinct. Review orally reasons for their extinction. Divide students into groups. Prepare a "television" film using strips of brown paper. Depict through drawings how extinction of animals and plants can be prevented. Have each student narrate his/her contribution.



URBANIZATION

OVERVIEW

Urbanization is the process by which increasingly large numbers of people are concentrated in relatively small areas called cities. Before 1920, the population of the United States was predominately rural; however, shifts in population to the cities have made it predominantly urban since that time.

The same pattern of urbanization is found throughout the world with the developing nations urbanizing at an even more rapid rate than the developed countries. It is expected that 60 percent of the world's population will live in urban areas by the year 2000, an increase of 35 percent since 1900.

People are attracted to the city by employment opportunities, social and cultural benefits, and accessibility to goods and services. However, as urban populations grow, the natural ecological system of the urban areas is disrupted, "people" space is diminished, and many personal and environmental problems are created.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Geography and resources were the basis for the original location of urban areas; the character of a city may be determined by the environment.

- 1.1 Research the history of cities established during the early days of the United States.
- 1.2 Who lived here before white settlers came? Collect Indian artifacts found locally. Discuss how Indians initiated efforts toward urbanization. Cite tribes who lived in colonies and in pueblos and discuss why some Indian tribes began to urbanize.

2. Early cities were initially established for the survival and well-being of people.

- 2.1 Study pictures showing early scenes of cities in your area. Compare with more recent photos. How are they different? What changes have been made? Why? Invite senior residents of the area to discuss urban living several years ago compared to the present. Have a question-answer session.
- 2.2 Study map of your original townsite. Has the town grown? How did the town grow? Why?
- 2.3 Study maps showing location of early settlers; why did they stop where they did?

3. The growth of urban areas affects all aspects of the environment.

- 3.1 Discuss how the growth of urban populations affects an ecological system.
- 3.2 Report on new means of generating power for cities.

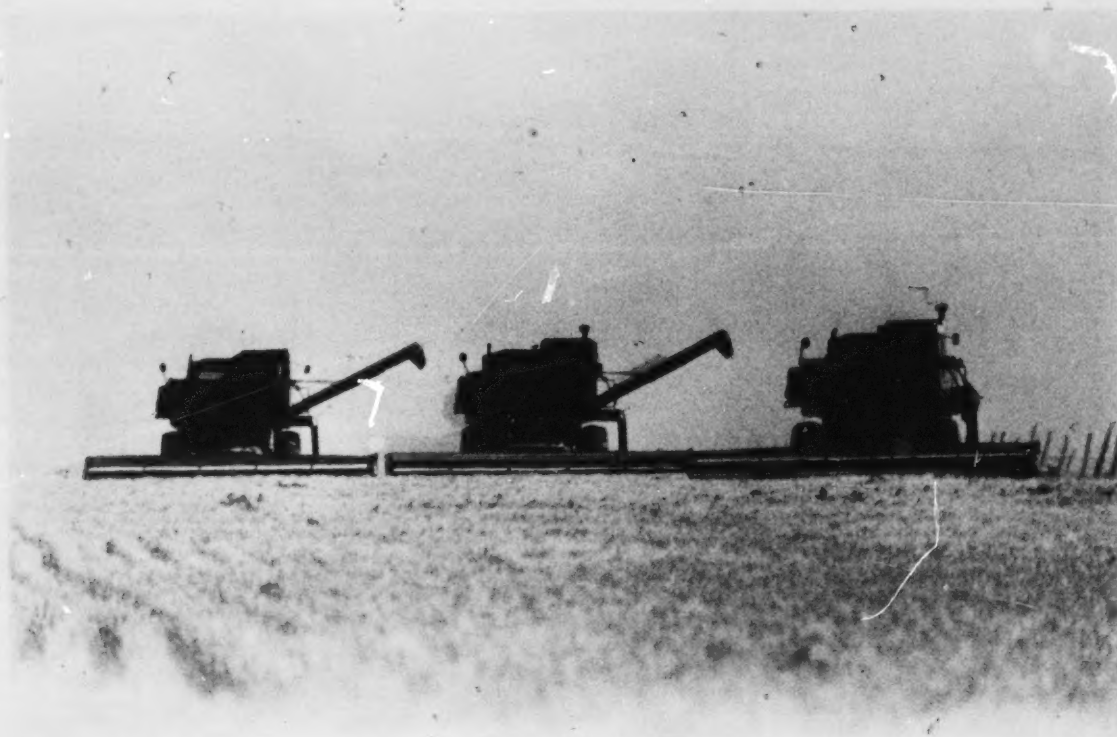
4. Cities disturb the natural environment and superimpose a new ecology.

- 4.1 Take a walk on the campus or to a park. Reflect on the same location as it may have looked 25 years ago, 50 years ago, 100 years ago. What caused it to change?

5. Planning based on sound ecological, humanistic, and social principles is essential in the development of urban centers.

- 5.1 Locate industries in the neighborhood. What do they produce or manufacture? Discuss occupations of people in these companies. What does the company manufacture or sell?
- 5.2 Invite experts to talk to the class: soil conservationist, engineers from the water treatment plant, sanitation inspector, specialist in radiation detection, ecologist, forester, geneticist, politician, religious leader, social worker.
- 5.3 Have school librarian identify picture books appropriate for young children which will depict life in urban and rural settings. Read some of these stories to young children. Have children role play life in a rural setting and in an urban setting. In their role play, direct children to dramatize why some people sometimes leave a rural setting for an urban setting or vice versa.





POPULATION AND ENVIRONMENT

OVERVIEW

The problem of overpopulation is the most serious environmental problem today. Overpopulation, coupled with the use and misuse of natural resources and energy, is a complex world problem that must be solved.

The present rate of population growth, unprecedented in history, has reached the point where future alternatives for population change must be mapped to preserve the existence and quality of life on this planet.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. World citizens should understand the implications of population trends and determine alternative plans for the future.

- 1.1 Discuss the following topics: Is the population pattern affected by the environmental pattern? Why do people migrate to certain areas? Why do people emigrate from certain areas? How do the population patterns affect the environmental pattern?
- 1.2 Discuss a ghost town. What are some reasons a town would grow into a city? Why would a town stop growing and die? What effect has the depletion of natural resources had on the growth of a town?

2. Increasing human populations, rising levels of living, and resultant demands for greater industrial and agricultural productivity promote increasing environmental contamination.

- 2.1 Locate data about the growth of population in specific areas: New York City; Phoenix, Arizona; Butte, Montana; your city.
- 2.2 Identify some of the effects of increased human population on other organisms.
- 2.3 For young children, initiate a project by having two guppy fish in a jar, such as a large-size pickle jar. Initiate the experiment by introducing the concept that living things grow and need space for expansion. In the science center, have a newsprint chart next to the aquarium. Several times each week have children observe changes and dictate them to the teacher so he/she may write down the observations. When the fish have multiplied, children should arrive at the conclusion that fish need a larger space to live in—then compare this fact to the needs of people.
- 2.4 Explore the neighborhood to find areas which are considered beautiful. List the standards considered desirable. Find some areas which are considered unattractive. Suggest possible changes.
- 2.5 Express orally or in writing the ways in which air pollution, water pollution, and visual pollution affect each individual.
- 2.6 With the principal's permission, ask the school custodian to "forget" to clean the classroom for one week. Predict what might be the result. Will it be in the middle of pollution? Why?
- 2.7 Write antipollution skits or songs.





THE PROBLEMS OF SOLID WASTE AND RECYCLING

OVERVIEW

Solid waste is defined as material which has no use in its present form and location. It accumulates in proportion to the activity of people, the growth of human populations, and the kinds of individual life styles.

Solid waste is moved from points of origin to points of environmental impact by both natural and human transport systems. It is important to identify the pathway of solid wastes, the forces influencing the choice of pathways, and finally their influence on human and natural systems.

To sustain human and natural systems, production, transportation, and utilization of solid waste materials must be managed in ways that are consistent with sound ecological and economic principles.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Solid waste is material that has no use in its present form and place.

- 1.1 Identify various types of solid waste and discuss different methods of its disposal.
- 1.2 What happens to the garbage and trash in your area? Is its disposal satisfactory? If not, why not? Discuss the origin of garbage and trash, the amount collected daily by the local community or a nearby city, and the kinds (those that disintegrate and those that last "forever"). Discuss how garbage can be re-used and why recycling and reprocessing are important.
- 1.3 Research the environmental effects of various products and practices: plastic containers, strip mining, discharge of industrial waste into rivers. Discuss the findings in class.
- 1.4 Have an exhibit day of items made from recycled materials.

2. Solid waste originates from the activity of people and is proportional to growth and current life styles.

- 2.1 Clean up the local area. Publicize and conduct a trash cleanup campaign; conduct a scavenger hunt for polluting objects; clean up a section of a creek or a mile of highway; collect and dispose of nonreturnable bottles.
- 2.2 Pick up trash around school and create a collage of trash.
- 2.3 Research ways of disposing of trash in ancient times.

3. Solid waste is recycled by both natural and human systems.

- 3.1 What is a compost pile? Build a compost pile and utilize it in a flower bed at school.
- 3.2 What does *biodegradable* mean? List items used in each home that are biodegradable and nonbiodegradable.
- 3.3 For young children, visit a commercial metal scrap yard. Lead children to observe how old cars are crushed into metal forms, readied for shipping in railroad cars and taken to factories to be used again. Conclude that objects can be used again by learning to plan. Request films from education service centers on similar topics.
- 3.4 Have children identify other objects that can be reused in various ways.
- 3.5 For young children, assign groups to survey the cafeteria and identify empty containers that could be used for a musical band, such as jars of different sizes, potato chip containers for drums, or bottle or jar caps for tambourines. Invite parents to assist children in assembling instruments. Request the music coordinator to help assemble the band and present it during a PTA meeting. Have children and parents tell about the project during a PTA meeting. Invite a local television station to televise the project.



SOUND POLLUTION

OVERVIEW

It is estimated that the average level of sound in the modern world increases at a rate of one decibel every year. Although a level of 80 decibels is considered loud and 120 decibels is dangerously high, some jet engines produce 103 decibels from 1,200 feet, subway cars create 105 decibels for passengers, motorcycles register well over 100 decibels, and jackhammers register over 120. Trucks with faulty mufflers can produce as much sound as 100 cars.

What are the consequences of this rising level of sound? It is estimated that three out of five human beings have suffered some hearing impairment, and many young people are prematurely deaf. Supersonic sound has been known to shatter windows, weaken foundations of buildings, and influence the health of humans and the productivity of farm animals.

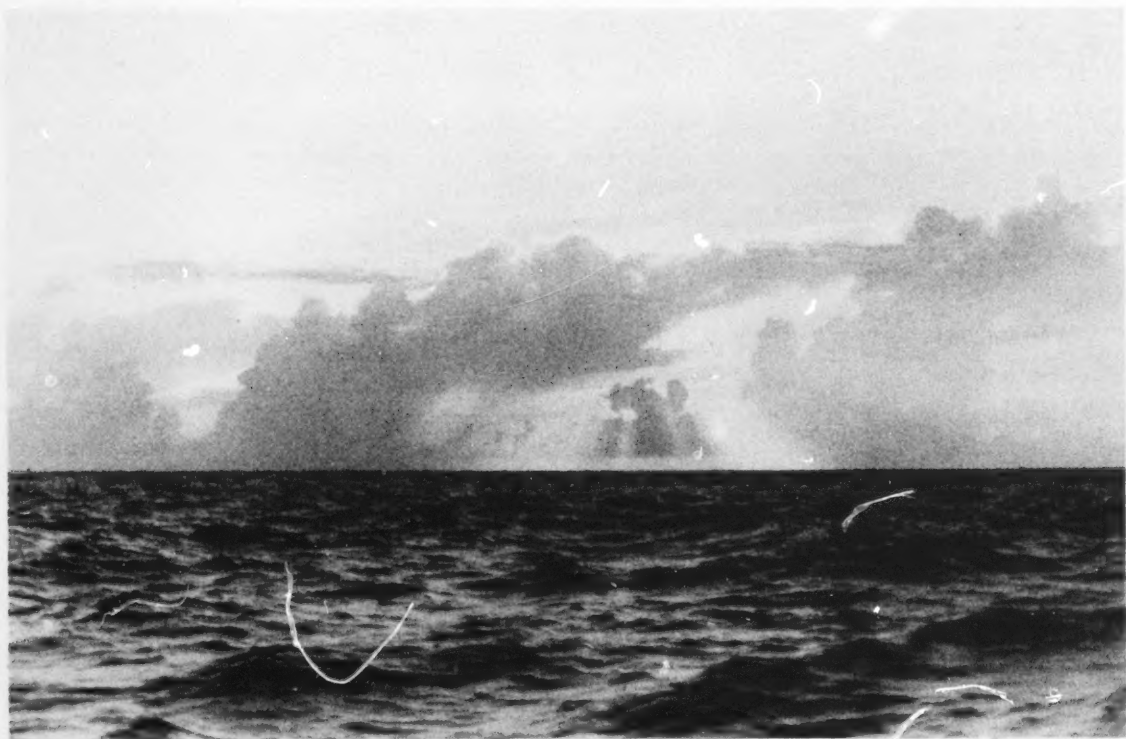
GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Noise is an irregular pattern of sound vibration. Pleasing sounds are produced by regular or harmonic vibrations such as those which produce music.
 - 1.1 Conduct unannounced tapings of sounds of your classroom.
 - 1.2 Tape sounds of a quiet area and of a noisy area of your community. Contrast these.
 - 1.3 Tape sounds in a home. Try to identify the sounds made.
 - 1.4 Study the means for measuring sound (decibels).
 - 1.5 Research to find legislation that has been enacted to curb noise.
 - 1.6 Research why airplane mechanics and runway workers wear ear protection.
2. Excessive noises have an adverse effect upon humans
 - 2.1 Discuss the harmful effects of noise. List pleasant sounds and annoying sounds. How are they different? Tape undesirable sounds. What would it take to lessen noise pollution?
 - 2.2 Sit quietly. List sounds you hear. Which ones would not have been heard 25 years ago? 50 years ago? 100 years ago?
 - 2.3 Demonstrate in class that different sounds make one feel sad, happy, or angry. Demonstrate how certain sounds are dangerous and can injure the ears. This can possibly be implemented through the use of a tape recorder.

3. Trees and shrubs absorb some noise and tend to reduce noise pollution.

- 3.1 Trees and shrubs make good noise absorbers. Discover places where a noise barrier should be planted in the local community.
- 3.2 For young children, initiate a project, requesting assistance from parents, which would entail making paper mache models using old newspapers. Make models of objects which produce loud sounds, such as jet planes, railroad engines, fire trucks. Collect items which help in minimizing noise, such as earphones and different types of ear wear. As part of the project, listen to soft noises and compare ways different noises affect people. Discuss ways noise level can be controlled in telephones, tape recorders, and record players. The teacher may assist children to understand that many noises can be controlled and need to be controlled to prevent hearing injuries.





WATER POLLUTION

OVERVIEW

Water is a primary resource upon which living things depend. It is the lifeblood of civilization. Water is one of the most common substances on earth. Next to air, water is our most important resource for survival. One can live longer without food than without water. Every living thing needs water to stay alive.

Ample supplies of good water make it possible for a nation to flourish.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Water is an essential resource.

- 1.1 List all the ways you can think of that you use water during one day.
- 1.2 Discuss what would happen if it never rained again.
- 1.3 For young children, initiate an experiment by planting some seeds in several containers. When plants have grown, continue to water half of them and do not water the rest. Let children discover that water is essential for existence.

2. Humans use and alter water.

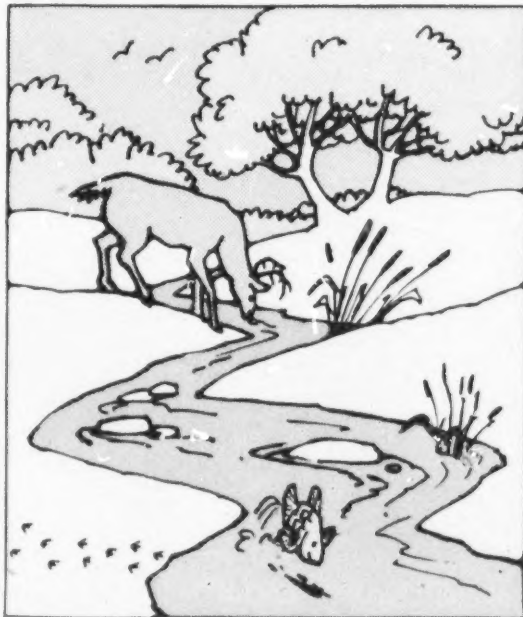
Visit a water purification plant.

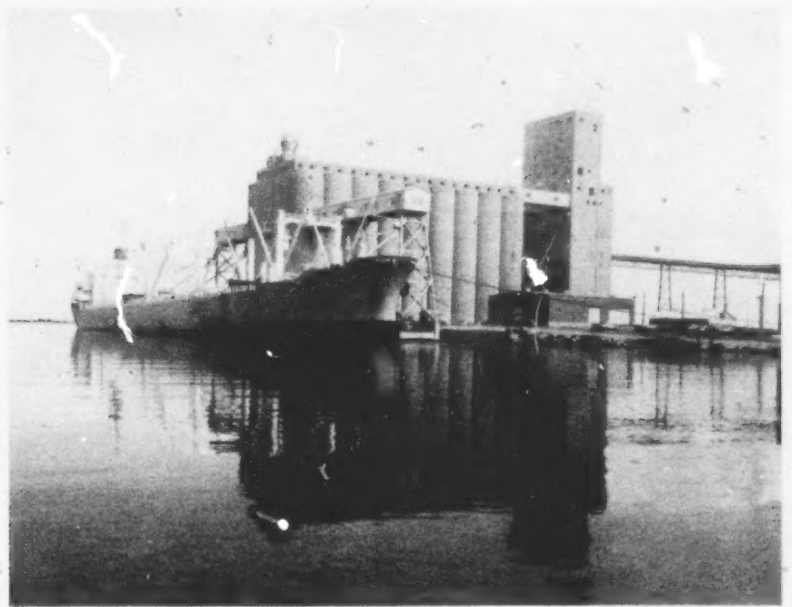
3. Water changes the face of the earth by causing erosion and weathering.

- 3.1 Make investigations of plants and animals after a rain.
- 3.2 Examine water areas near your community. Observe conditions of weathering rock formations, water, and wind erosions. Identify environmental/ecological problems.

4. Water is a reusable and transient resource, but the available quantity may be reduced or the quality impaired.

- 4.1 Report on water pollution in your area. Include information about state and local water pollution control programs.





FOOD POLLUTION

OVERVIEW

Many changes are occurring in methods of mass producing, transporting, storing, packaging, and marketing food. However, in these changes are inherent dangers and threats to human health and survival. Artificial hormones, antibiotics, dyes, flavorings, and preservatives have been added to food; remnants of fungicides and pesticides are found in agricultural products; wastes, poisons, and refuse are sometimes included in large-scale food production.

GENERALIZATION AND SUGGESTED PUPIL ACTIVITIES

1. The composition of food is modified to enhance its quality and quantity and for the sake of convenience.
 - 1.1 Discuss the value of food additives.
 - 1.2 Listen to a resource person (Texas Department of Health Resources) explain laws governing food handling, food care, and food preparation. For young children, the concept will be developed on a simpler basis: How foods are preserved. An activity could consist of visiting the school cafeteria for one or two occasions to identify how foods are preserved.



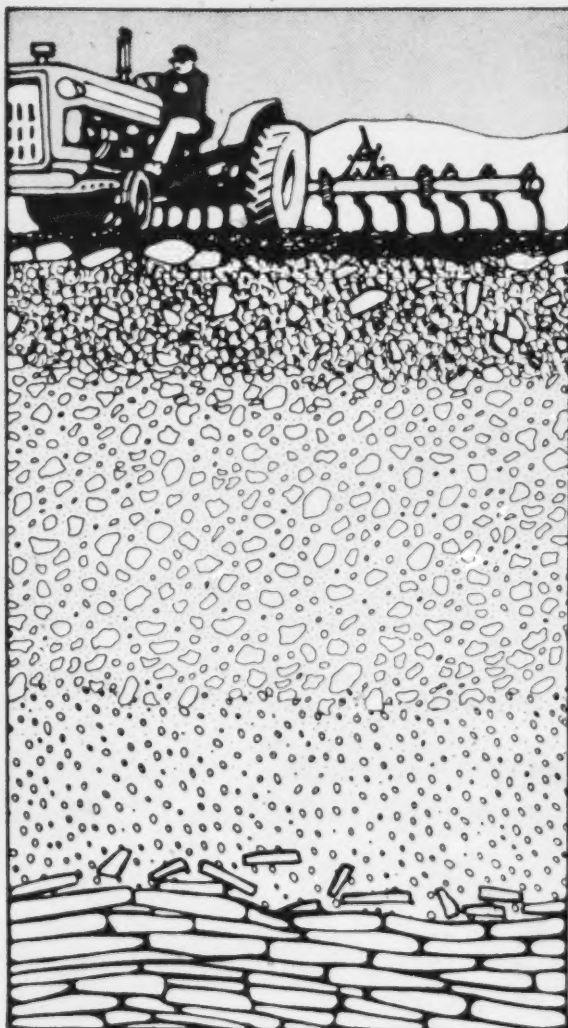


SOIL POLLUTION

OVERVIEW

Although the soil is merely a thin film that covers a small part of the earth's surface, it is essential to life. The soil has many uses; it is the medium and an active participant in essential ecological processes.

The cultural, social, and economic development of different regions is related to the variations in soil from locale to locale. The future of all life is dependent on the wise management of the soil both locally and internationally. The population increase makes it imperative that an intelligent conservation ethic regarding soil be developed.



Soil is essential for the growth of plants and trees. Plants and trees are essential for the energy cycle; consequently, soil is an important link in the continuation of human life on earth.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. **Soil is important for holding plants, serving as a habitat, recycling nutrients, and purifying water.**
 - 1.1 Observe an ant colony.
2. **Humans are capable of managing the soil through cultivation, irrigation, mining, industrial landfill, and construction.**
 - 2.1 Study soil and suggest reasons for barrenness of some soil. Plan and execute a series of efforts to make the soil capable of producing food plants or ornamentals from seeds or transplants. Take photos before and after to show how you make your selected "desert" bloom.
 - 2.2 Study what has happened to areas near large rivers before and after dams were built along the river.
 - 2.3 During a visit to a park or recreational area, the teacher may guide the children to conclude that people can manage the soil by taking care of it so it can in turn help produce beautiful trees, grass, and plants.
3. **Soil must be protected from erosion caused by wind and water.**
 - 3.1 Observe and discuss what happens when water run-off washes away topsoil.
 - 3.2 Examine trees along a stream. What purpose do they and their roots serve?
 - 3.3 Study ways that people in the western plains prevent soil erosion by the winds.
 - 3.4 Visit various local sites (such places as a golf course, sand and gravel quarry, abandoned business site, or a sanitary landfill operation) and view erosion and flood damage. The local city building inspector can probably offer a list of local "mistakes" worth viewing. Develop models in the classroom to illustrate prevention of soil erosion.
 - 3.5 Take pictures of the local sites. Develop slide presentations. Place in resource center for the use of other classrooms.
 - 3.6 Study the effect large paved areas have on natural deterrents to erosion.



AIR POLLUTION

OVERVIEW

The air we breathe today is a mixture of various gases as well as some solids and liquids. These gases, essential to all life, have resulted from evolutionary changes over billions of years. Since all life is dependent on one or more of the air's constituent gases for survival, gases are the common property of all living organisms. Air pollution is of vital concern because of the differing tolerance levels of various life forms.

The eventual survival of species is threatened by various possible air-related catastrophes such as the destruction of the oceanic plankton which produces 70-80 percent of the earth's oxygen; and health problems in humans, especially emphysema and related respiratory diseases.

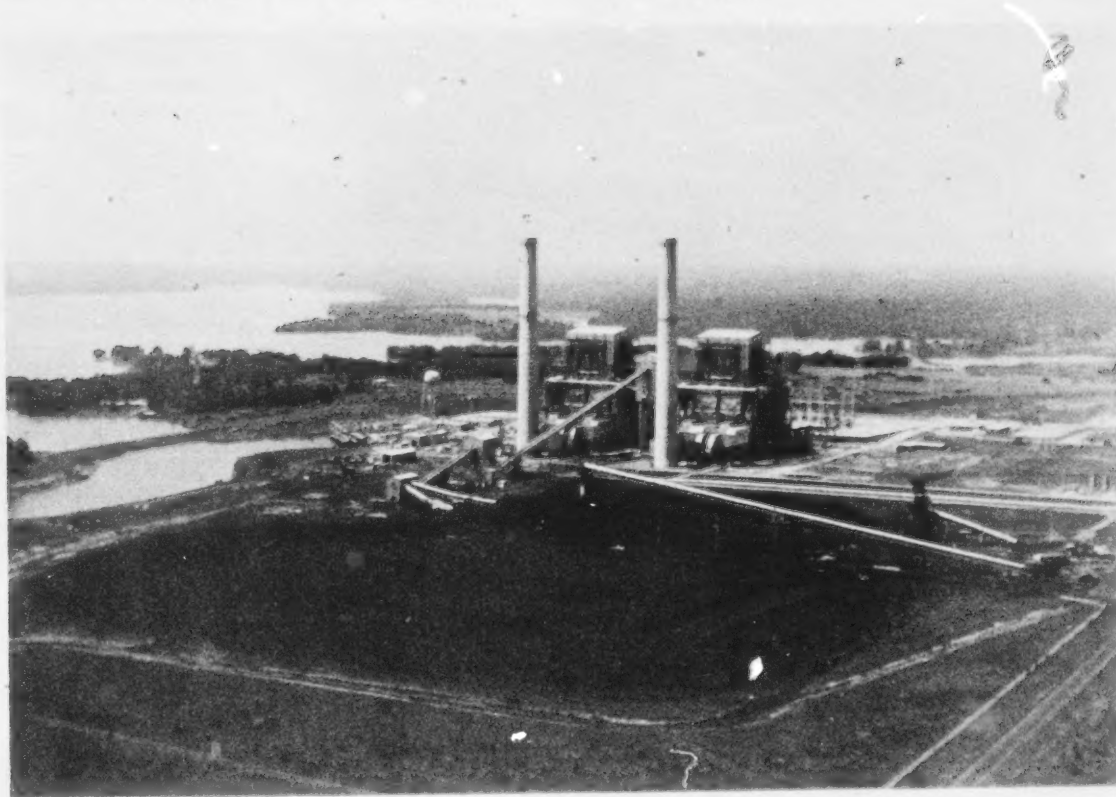
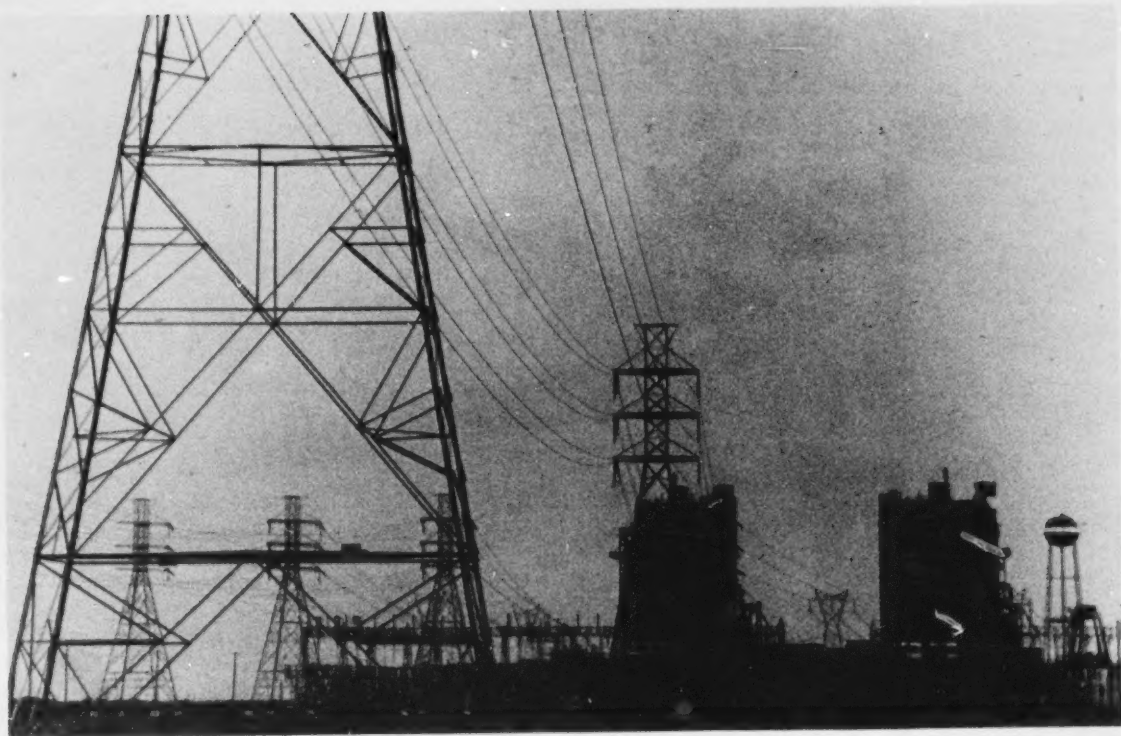
Natural, geographic, and people-made environments also modify the patterns of air pollution. Local, regional, and national air pollution problems are inter-related.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Properties of polluted air are affecting the health and well-being of plants, animals, and nonliving things which share this planet earth.



- 1.1 Discuss why the amount of air pollution increases with industry and increasing population. Predict what will happen in the future.
 - 1.2 Discuss "no smoking" laws; list reasons for passing such laws.
 - 1.3 To demonstrate sources of people-made pollution (auto engines, burning fuels, and waste products), show effects of incomplete combustion of fuels. Demonstrate with a Bunsen burner the amount of carbon produced with various proportions of air and gas.
 - 1.4 Discuss ways automobiles may pollute the air besides with fumes from the engine.
 - 1.5 To show that the major source of urban air pollution is the automobile, stand at a corner near your home for five minutes and count the cars and trucks that pass. Record the number that are emitting blue or black smoke.
 - 1.6 Discuss why housecleaning has to be repeated so often.
 - 1.7 Discuss air pollution as a cause of disease.
 - 1.8 Trace the development of the word *smog* and report on Dr. DeS Voeus who coined the word.
 - 1.9 Demonstrate the effect nicotine has on a tomato plant.
 - 1.10 Study industries that create pollutants and how their workers and families are affected by these pollutants.
2. Plants and trees help clean the air and provide the oxygen needed for life.
 - 2.1 Discuss how indoor plants can be beneficial as well as beautiful.
 - 2.2 List benefits of green areas.
 - 2.3 Describe how trees clean the air of pollutants and carbon dioxide, help control winds, temper the climate, and provide oxygen. Collect leaves from different trees. Observe the collection of soot, lint, and dust on the leaves. Arrive at inferences.
 - 2.4 Discuss what is meant by *green belt*.



THE ENERGY CRISIS AND DEPLETION OF NATURAL RESOURCES



OVERVIEW

Increased world population and improved standards of living have raised the consumption levels of energy and natural resources to an alarming amount. Research and applied technology have not yet discovered solutions to reverse this environmental crisis.

If we are to reverse the trend of increasing energy use, it is essential that people understand the basic principles and interactions of matter and energy. We must examine closely the use and abuse of energy and natural resources in the past and present.

The student can be made aware of this environmental crisis and plan present and future use of natural resources through wise management. Such planning should include economic, political, and socio-logical factors.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Energy is found in several forms. The form of energy can change, but some energy is always lost in the process.

- 1.1 Study history of the use of various types of energy:

- Human
- Wheel, ramp, pulley (simple machines to multiply effort or speed)
- Windmill, wind charger, coal, steam, battery
- Electric, gas
- Solar (experimental)
- Nuclear

- 1.2 Develop an experiment using different sources of energy for heating in winter. Use as samples a fireplace, a gas heater, and an electric heater. Show that all these means of heating must have a source of energy. The teacher may guide the children to conclude that, in order to keep warm in winter, people need to conserve the sources that facilitate this convenience.

2. The sun is the earth's major source of energy. Its light is absorbed and used by plants to manufacture foods, it gives energy in the form of heat, and its heat can be converted into electrical energy.

- 2.1 Students may concentrate sunlight by the use of a magnifier to show that sunlight has energy (Caution: Do not look at the sun; its energy will burn the eyes.)

- 2.2 Put a thermometer in a white paper envelope and a second thermometer in a black envelope. Place them in the sunlight. Observe and graph the change in temperature versus time.

3. Some resources, called nonrenewable, are used up.

- 3.1 Discuss the use of nonrenewable resources and renewable resources.

- 3.2 Find information related to the shortages of natural resources.

- 3.3 Search current magazines and newspapers for information related to problems of energy use.

- 3.4 Describe proposed ways to solve the energy crisis or shortage in the United States.

4. Population growth and technology increase demands for resources and have an increasingly profound impact upon the environment of the world.

- 4.1 Discuss the reasons for the increased use of energy.

- 4.2 Write stories about the ways people have improved or harmed the environment.

- 4.3 Determine the principal energy sources used in the United States.

5. Conversion of natural resources to energy for human use requires varying amounts of energy.

- 5.1 Show by sketches how electricity is generated from (1) water, (2) natural gas, (3) coal, and (4) oil.

- 5.2 Suggest new sources of energy to supply the needs of the world.

- 5.3 List ways each person can help in solving the energy shortage.



TRANSPORTATION AND THE ENVIRONMENT

OVERVIEW

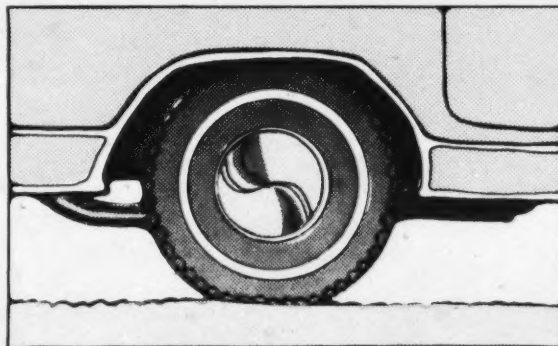
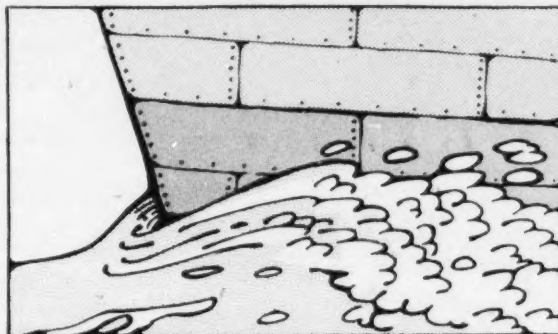
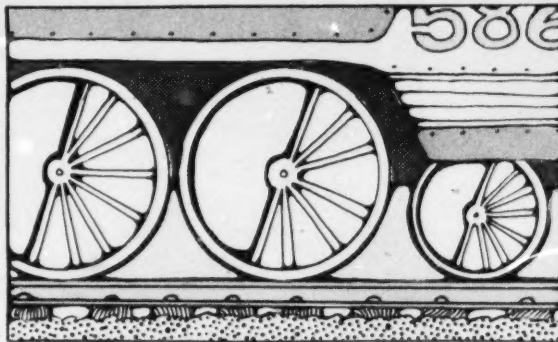
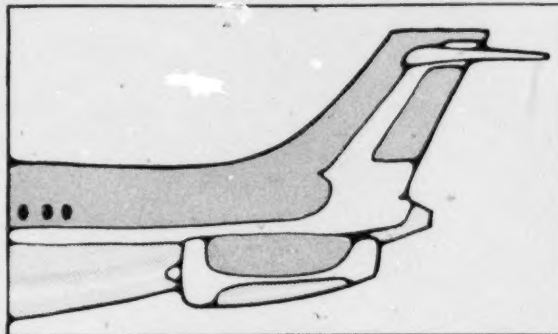
Transportation has helped transform American society from rural, agrarian to urban, industrialized. Various kinds of transportation have been involved in this process and have had varying effects on the environment. The choice of transportation has produced certain stresses on environmental systems.

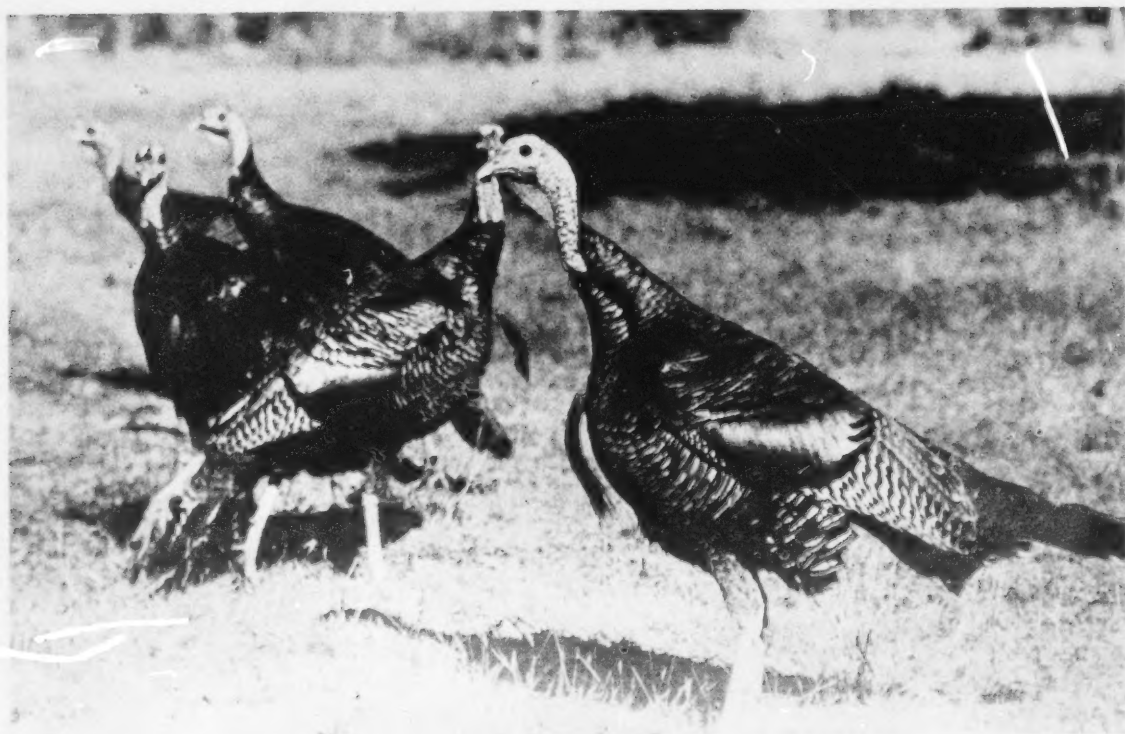
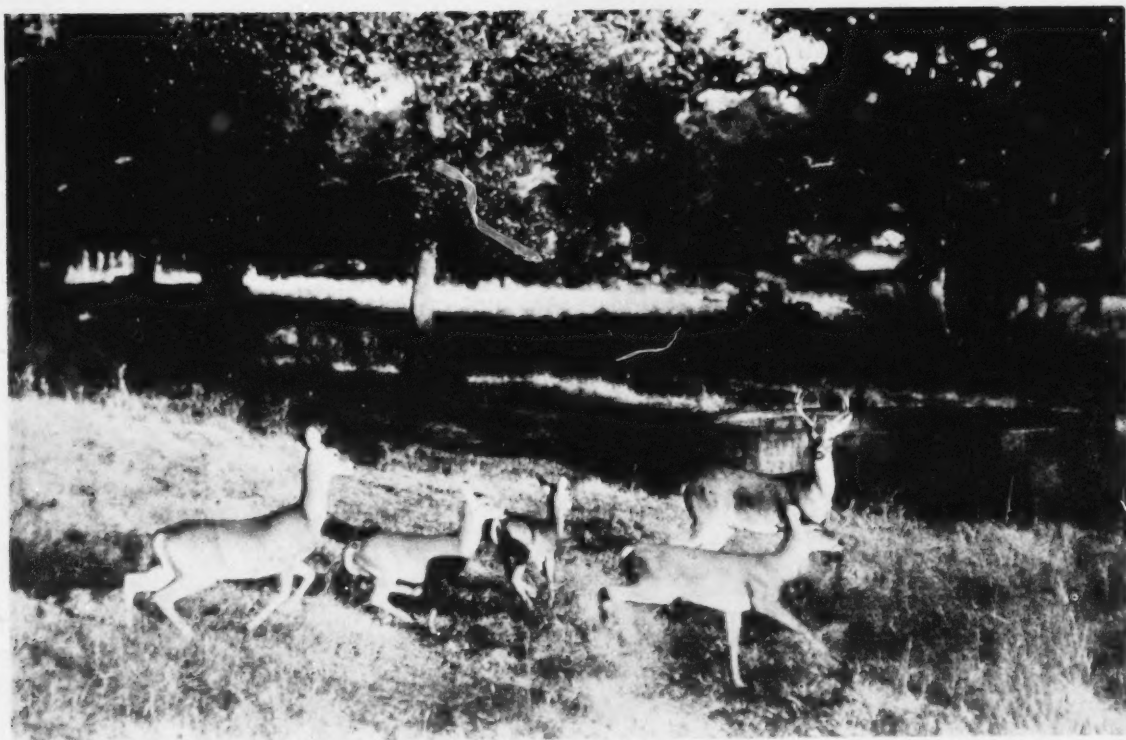
GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Transportation is essential to the fulfillment of the basic needs of food, clothing, and shelter and has a major effect on an individual's life style.
 - 1.1 Discuss how basic needs were met 100 to 200 years ago and how they are met today.
 - 1.2 The teacher may take young children to a street corner. Identify vehicles and what they are carrying. Determine how many of these items are essential. Discuss how transportation has a major effect on our lives.
 - 1.3 Conduct a study in your city to determine what changes have taken place in the last two or three years because of transportation needs, such as tearing down homes and buildings to make space for new bridges, streets, and parking lots.
2. Technological advances have affected modes of transportation.
 - 2.1 Identify antipollution laws regarding modes of transportation and the effects these laws have had upon industries.
 - 2.2 Discuss reasons for the decline of railroad travel.
3. Most modes of transportation have a direct effect on natural resources.
 - 3.1 Write central offices of automobile manufacturers for information about improvements in pollution control.
 - 3.2 Prepare reports or panel discussions about the advantages or disadvantages of the automobile, such as the following:

Disadvantages
Pollution
Using up arable land

Advantages
Employment for millions
Fast communication





WILDLIFE

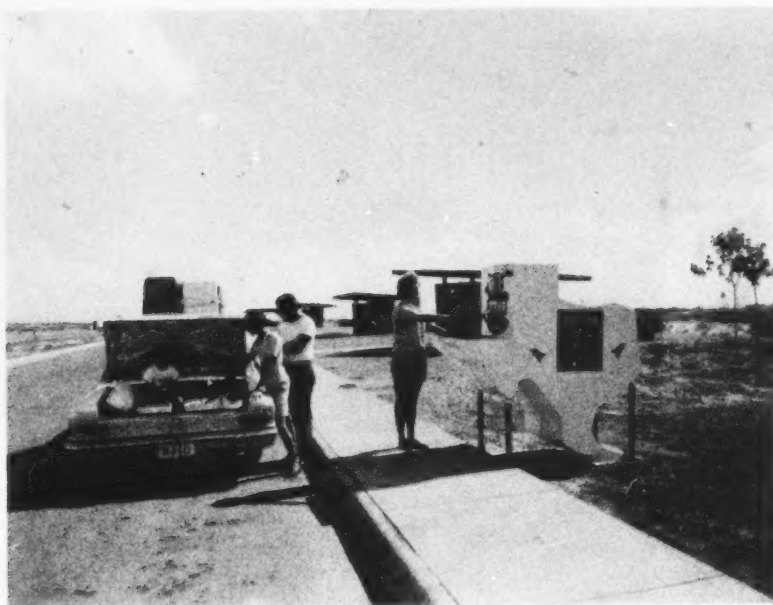
OVERVIEW

Wildlife is a precious resource because once a species is extinct, it cannot be re-created by any means presently available. Protection of wildlife is very important.

Population growth, destruction of habitats, and increased technology throughout the world are threatening wildlife on a global scale. Wildlife management, therefore, should be presented to students so that they will have a realistic and balanced view of the current situation.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. **Wildlife species deserve protection from extinction.**
 - 1.1 Visit museums or see a film about species that are extinct.
2. **Diversity of species makes earth an interesting, stimulating habitat for all people.**
 - 2.1 Classify things in a particular environment as animal, vegetable, or mineral. How many varieties are there? Are there any similarities? Sketch the objects noted in various graphic forms and discuss their variety and similarities.
 - 2.2 Discuss certain creatures such as snakes, wolves, spiders, toads, and humans. List ways these creatures help people and hurt people.
 - 2.3 Go on a short trip around the neighborhood where plants may be observed. Observe differences resulting from varying care, nutrition, light, and other elements.
 - 2.4 Bring small animals to class to watch their growth and development.
3. **People must recognize that nonhuman entities have their place in the ecosystem.**
 - 3.1 Make a survey of the area, indoors and outdoors. Compile a checklist of wildlife common to the area. Observe habits of the wildlife and determine which are considered "pests" in your community. Check on controls to eliminate these pests.
4. **Human endeavors are related to the survival of wildlife species.**
 - 4.1 Obtain information from a game warden about hunting regulations in the area and explain why certain animals may be hunted only during the specified seasons.
 - 4.2 View free films on wildlife from various sources: Texas Parks and Wildlife Department, Audobon Society, and National Park Service.
 - 4.3 Build a bird feeding station at home. Offer several types of foods. List the different kinds of birds observed and which kinds of foods they seemed to like best. Report results back to the class.
5. **Certain species are currently in danger of extinction.**
 - 5.1 At least 86 species of wild animals (mammals, birds, and reptiles) are now in danger of extinction. Identify some of these found locally and make recommendations on how to alleviate this situation.
 - 5.2 Check books from library, such as those on prehistoric animals and plants. Check films from resource center. The teacher may guide children to conclude that wildlife needs to be conserved and the numbers controlled so they may continue reproducing.
6. **A species' ability to change may not be equal to the demands placed upon it by the manipulation of the environment.**
 - 6.1 Compare elimination of predators and consequent elimination of animal species. Investigate other examples of natural balance.
 - 6.2 Invite a resource person from the Texas Parks and Wildlife Department to discuss the balance of nature.
7. **Native species may be better adapted to a habitat than introduced species.**
 - 7.1 Visit a nearby park, wooded area, or pond. List the plants and animals that are the same as, and those that are different from, the ones found in your immediate community. Explain the physical characteristics of the plants and animals that enable them to live where they do.
 - 7.2 Develop a nature trail. Choose an appropriate location and clear it of debris. Establish the trail, planting or transplanting vegetation along the trail as needed. Study features of the trail. Make signs for describing plants, animals, ponds, land formations, and rock and soil types. Possible later additions might be a weather station; bird feeders; an observation tower; and displays such as cross sections of logs or a bridge over a stream.



WHAT INDIVIDUALS CAN DO

OVERVIEW

Learning about the environment should be an active process in which students participate in the solution of environmental problems. An active approach is recommended for two reasons: First, research shows that this method is conducive to learning, and, second, critical environmental problems lend themselves easily to an active, problem-solving approach. Student involvement, under the guidance of a well-informed person, should be responsible and intelligent and it should lead to sensitivity about the environment, individual growth, self-esteem, and commitment.

Such a learning process not only facilitates the student's current learning, but provides a model for future study and action.

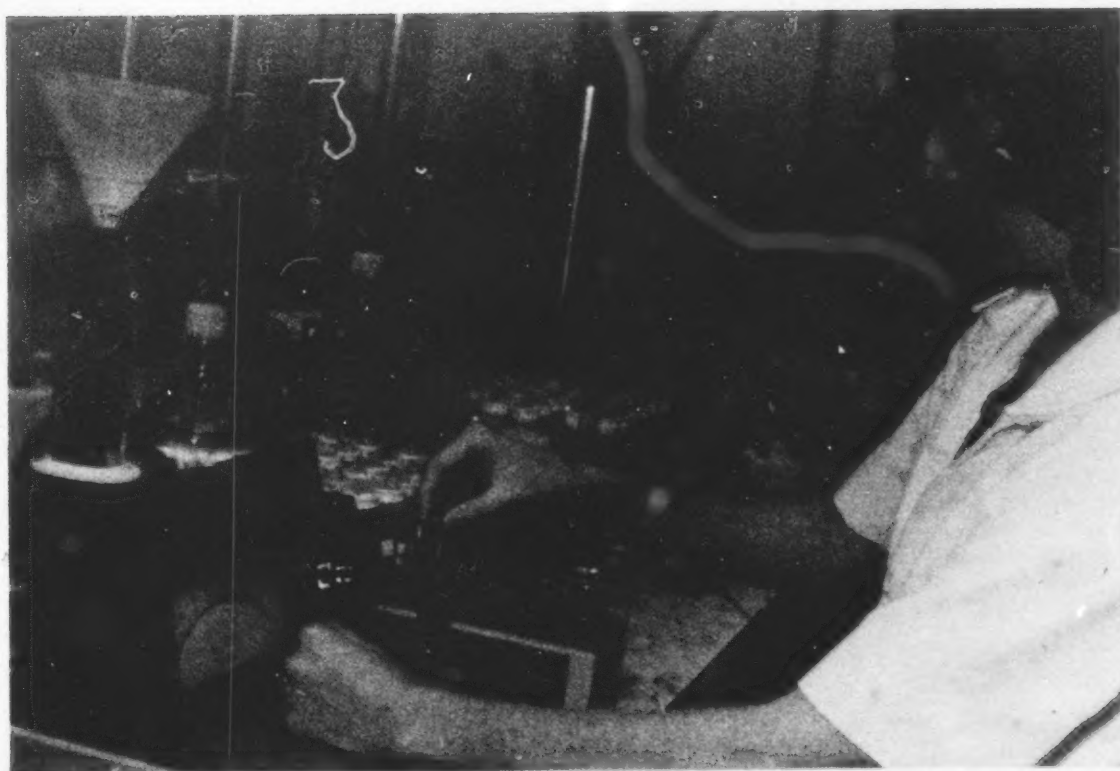
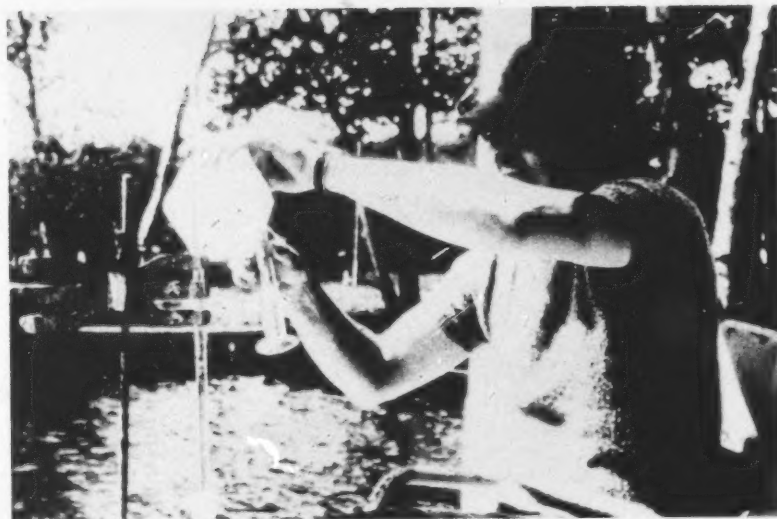
Individuals must become informed about environmental problems and accept responsibility for the quality of the environment.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Student involvement and concern will lead to a cleaner, safer environment.

- 1.1 Initiate awareness to changes brought about by governmental agencies. Invite a city councilman to explain how a proposed ordinance may be presented to the city council.
- 1.2 Start your own compost pile of leaves and other wastes. Use the nutrient material on your lawn or garden.
- 1.3 Compile and publish a list of methods that will cut down on household waste and stop pollution.
- 1.4 Make a list of proposed ordinances. Role play how these can be presented to the city council. Then have a representative group present them to the city council, the student council, and the teacher council.

- 1.5 Conduct a paper and metal can drive in your community to encourage recycling.
- 1.6 Start an informative environmental section in the school library.
- 1.7 Plan and carry out planting and beautification projects on the school grounds or in the community.
- 1.8 Take field trips to polluted areas, industries, and examples of model pollution control; go on ecology hikes.
- 1.9 Sponsor a tree planting project.
2. **Environmental solutions are the responsibility of the informed citizen.**
 - 2.1 Study ways which will minimize personal contributions to pollution.
 - 2.2 Visit a recycling center. Have a resource person show a film on the value of recycling such items as paper towels, sacks, milk cartons, and roofing materials.
 - 2.3 Invite resource speakers who are knowledgeable of the problems in the community and who are able to present possible solutions to these problems—especially those problems in which students will be able to participate in the solutions.
 - 2.4 Study the four major concepts relative to the environment:
 - Scarcity
 - Interdependence
 - Personal responsibility
 - Value conflicts
 - 2.5 Prepare reports on science and the war on pollution. Stress such questions as these: Are you doing your part to help? Are you part of the problem or part of the solution?



IDENTIFICATION OF ENVIRONMENTAL PROBLEMS

OVERVIEW

Human beings are at a very critical state. The planet has been treated in such a way that the extinction of humans is possible if the present patterns of destroying the life-sustaining qualities of the earth are continued.

Humans are intellectual beings capable of perpetuating or destroying the species. A changed value system and behavior toward the environment is necessary if the human race is to survive. A cooperative effort on the part of the international community is necessary if the balance in nature is to be restored.

As inhabitants of the earth, human beings are part of the space, time, and energy process by which all things exist. This process is limited. The earth's diameter is only 7,926.4 miles and 71 percent of its surface is covered with water; its biosphere supports all life. As the only species on earth capable of intelligent action and planning, humans must develop an environmental awareness.

Humans, as part of the system earth, use air. In the discussion on "The Oxygen Cycle" in the September 1970 issue of *Scientific American*, Cloud and Gheor state that "the earth's atmosphere is thoroughly mixed and so rapidly recycled through the biosphere that the next breath you inhale contains atoms exhaled by Jesus and Hitler. . . . It also contains atoms of radioactive strontium 90 and iodine 131 from atomic explosions and gases from the chimneys and exhaust pipes of the world."

In a world where there are natural noises, humans have made additional contributions to the level of sound. One may recognize a quiet atmosphere as a sign of a pleasant community. However, it is estimated that three out of four Americans have suffered some hearing impairment, and deafness becomes more common among civilized people in a world which grows noisier each year.

The greatest environmental problem is overpopulation. It is estimated that the population of the earth,

which at one time was doubled every 1,000 years, is doubled now every 35 years. Overpopulation is bringing with it a certain devaluation of human life, as well as problems in urbanization, waste disposal, air pollution, water pollution, land pollution, and the depletion of natural resources, wildlife, and food supplies.

GENERALIZATIONS AND SUGGESTED PUPIL ACTIVITIES

1. Violation of the laws of ecology lead to environmental problems.

- 1.1 Discuss the problems which result from a violation of ecological laws, such as using pesticides for spraying plants and dumping garbage into open streams.
- 1.2 Identify sources of pollution in the local area.
- 1.3 Identify an area near the school or home which is overused. State the problems and discuss possible solutions.
- 1.4 Prepare reports on such topics as these:
 - a. Can the World Be Saved?
 - b. Nature Under Attack
 - c. Game Ranching: Wild Animals Can Be Used as a Source of Food. (Study this proposition and evaluate it.)

2 Each person fulfilling his or her commitment to a clean environment can correct the problems which exist.

- 2.1 Establish an environmental corner in the library—books, clippings from newspapers and magazines, pictures. Have an ecology bulletin board.
- 2.2 Make a list of activities for improving the environment in which the class can participate.
- 2.3 Create puppets and prepare a puppet show relating to environmental education topics.